CASE STUDY – DOMAIN CENTRAL SHOPPING CENTRE TOWNSVILLE QUEENSLAND

Executive Summary

Trial Date Commenced: 25th March 2014 and was completed 28th April 2014

Domain Shopping Centre is situated in Townsville North Queensland and is the largest "big box" shopping centre is Australia and is spread over 50 hectares. Its retailers are among Australia's leading retail brands being Harvey Norman, Bunnings, JB Hifi to name a few. The unit that the trial was carried out on was servicing the Specsavers store.

Smartcool Systems Australia and Ensol Systems carried out a trial on the effectiveness of the Smartcool system and Aeris treatment on a Temperzone 180kWr DX Package Unit at the Domain Shopping Centre in Townsville.

The test was carried out over a 4 week period. A day from each week was selected where ambient conditions on those days were as close as possible to the corresponding days in the associated weeks. From this information we were able to identify the improvement in space temperatures and energy reduction of the air conditioning unit.

The Energy Consumption Results were:

		kWh	431.2
		Rel Hum	76%
		Min Temp	22.9
		Max Temp	30.1
AC Controls Only		Base Conditions	

kWh		389.0
Daily Difference		42.2
Rel Hum		94%
Min Temp		24.1
Max Temp		30
Smartcool Only		9.8%
Rel Hum Adjustment 3%		12.80%

kWh		401.6485
Daily Difference		29.6
Rel Hum		68%
Min Temp		24
Max Temp		30.3
Aeris Only		6.9%

		kWh	333.6
	Daily Difference		97.6
		Rel Hum	75%
		Min Temp	25
		Max Temp	30.4
Smartcool and Aeris			22.6%

A 22.6% energy reduction is an excellent result for this size unit, and shows the effectiveness of the combination of Smartcool and Aeris solutions.

The energy reduction relates to approximately 35,331kWh per annum reduction and at a rate of 26 cents per kWh is a saving of $9,186.00 per annum.

There was a 113% increase in the air flow through the coil after the evaporator coil was treated by the Aeris solution as per the results below:

Original Air Flow		**Airflow after Treatment**		**Airflow with Smartcool**	
2.09	m/s	4.46	m/s	4.44	m/s

Original Temperatures		Smartcool Only		Aeris Treatment		Smartcool & Aeris	
Air Off	Air On	Air Off	Air On	Air On	Air Off	Air On	Air Off
14.97	**22.99**	**17.06**	**23.29**	**15.74**	**23.07**	**18.28**	**22.96**

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The most important result from the Air On/Air Off data is the Air On with Smartcool and Aeris combination as this represents the internal building temperature. This has allowed the internal temperatures to control closer to set point with the Smartcool system running.

Methodology to Gain the Results

Several logging systems were set up to authenticate the results of the test.

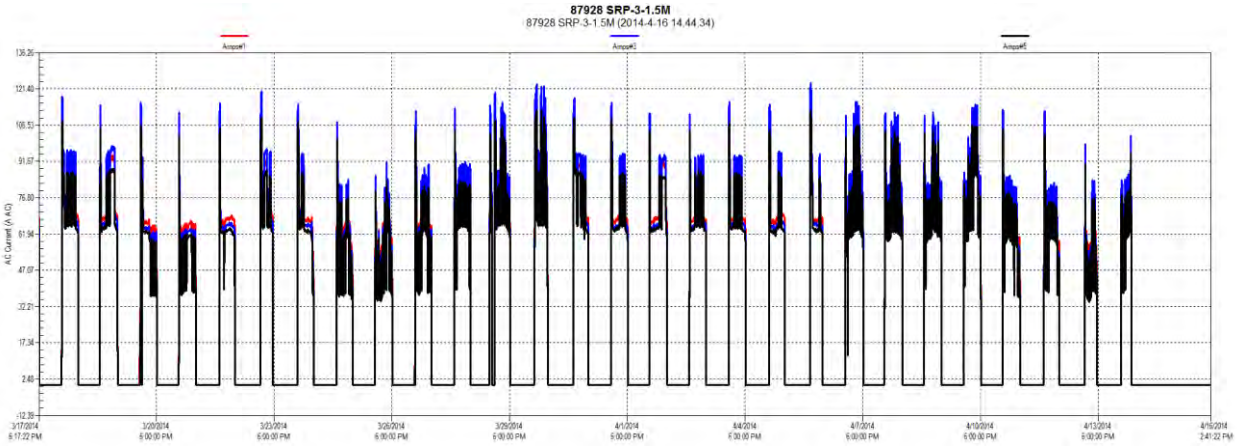
- An ACR Smart Plus current logger was used to record the current consumed by the air conditioning unit. The current was then converted to calculate the kWh consumed.
- An ACR Smart Plus temperature logger was used to measure the air ON and OFF the coil
- An ACR TJR Temperature/Humidity logger was used to measure the temperature and humidity in the return air, which is also representative of the space conditions.
- A Lutron Electronics hot wire anemometer (air flow logger) was used to measure the temperature and air flow before and after the evaporator coil was treated.

The data was collected from all of these loggers and analysed to obtain the results.

There was some temperature variation throughout each day of the trial, but the largest contribution to the change was the relative humidity, which places additional load on the air conditioning system. The week when the Smartcool system was running had extremely high relative humidity and an adjustment to the energy consumed relative to the other days of the selected data was made.

Recorded Data

Power consumption



/----Control Only------/-Smartcool Only--/------Aeris Only--------/---Smartcool Aeris----/
/--------Week 1--------/-------Week 2-------/--------Week 3----------/---------Week 4--------/

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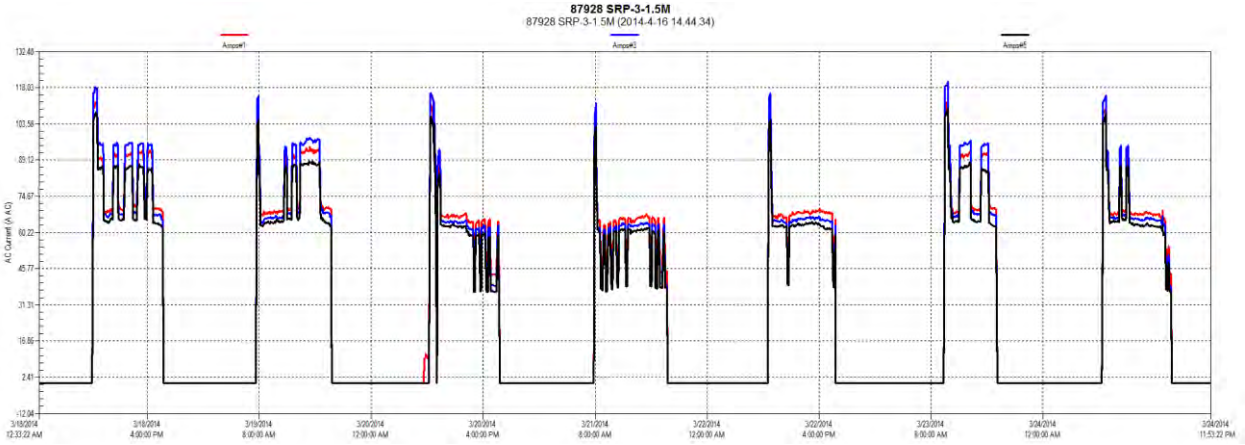
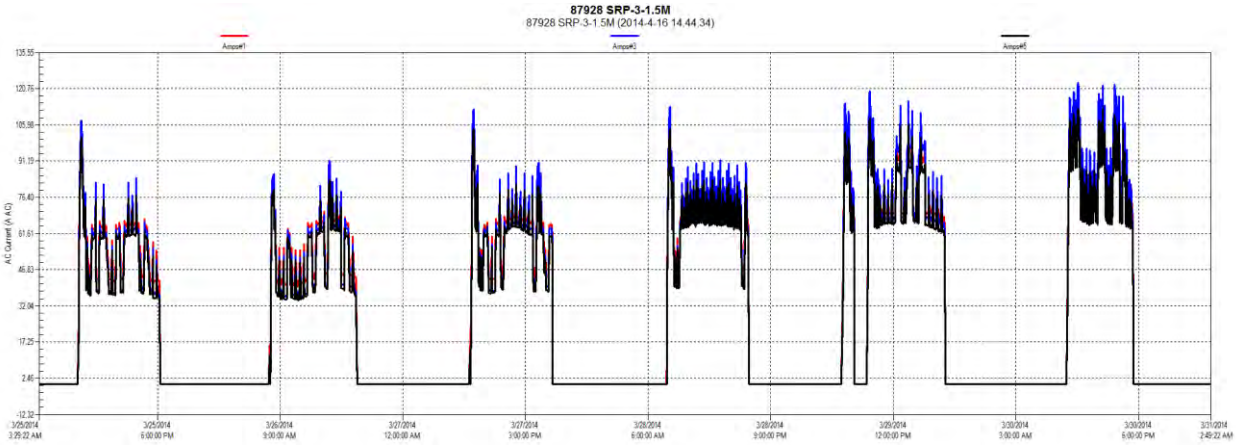
Week1 Base Line Power Consumption

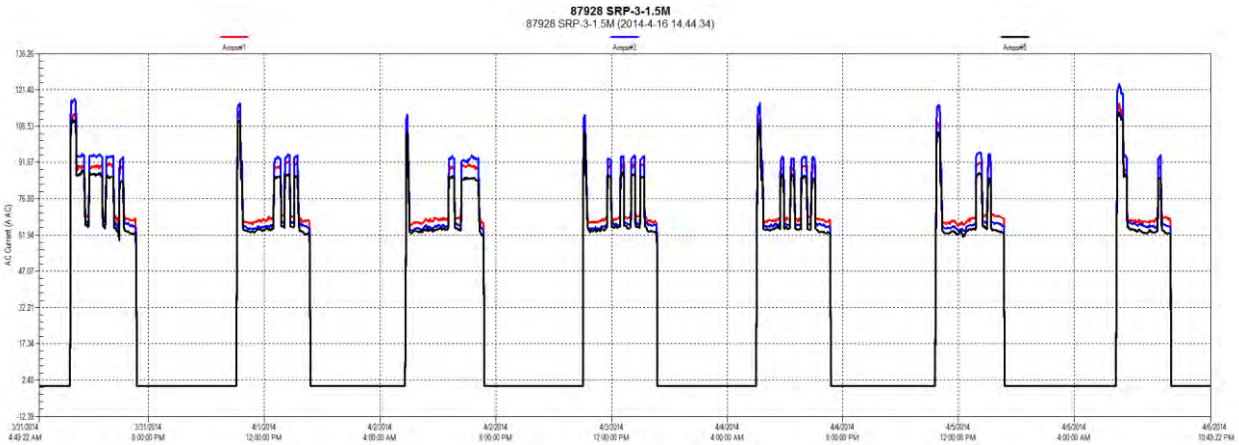


Note the set point was reduced by 1.0ºC by others on 23/3/14, hence the increased consumption at the same ambient conditions for 20, 21 and 22/3/14.

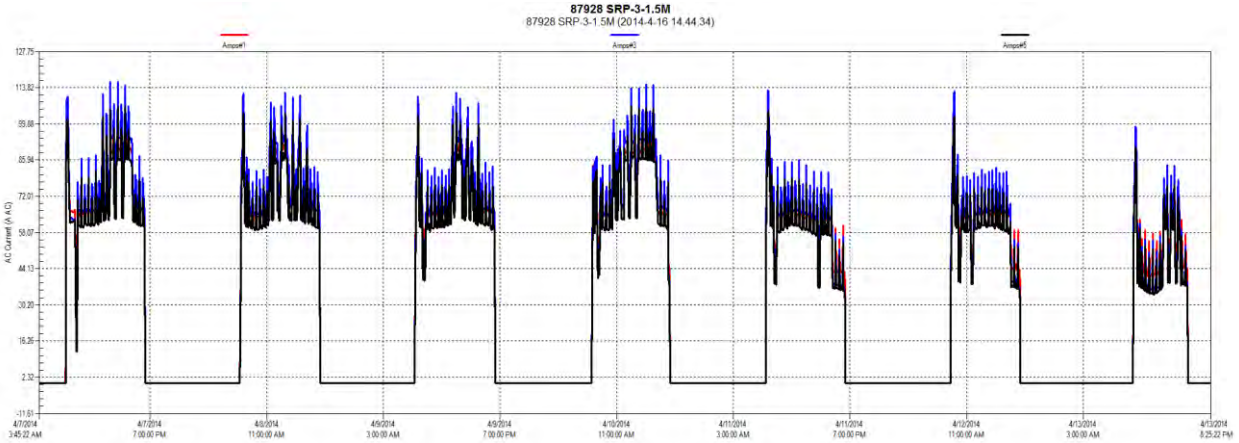
Week 2 Energy Consumption Smartcool Only



Week 3 Energy Consumption Aeris Only



Week 4 Energy Consumption Smartcool and Aeris

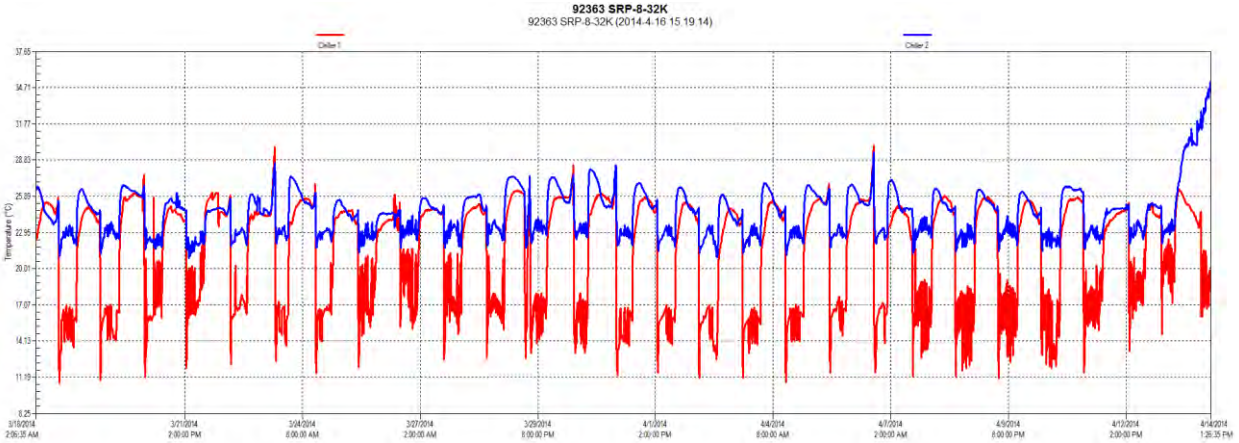


Temperatures

There were several temperatures recorded at various points on the air conditioning unit to allow us to identify an accurate result and the exact effect of the ambient conditions on the operation and power consumption of the air conditioning unit.

Air On and Air Off the Evaporator Coil

The following graph shows the air Off (Red) and air On (Blue) temperatures to the evaporator coil for the duration of the trial.



/----Control Only------/-Smartcool Only--/------Aeris Only--------/---Smartcool Aeris----/
/--------Week 1--------/-------Week 2-------/--------Week 3----------/---------Week 4--------/

Week 1 Existing Controls Only, Air On/Air Off temperatures

This data shows irregular control from the existing controller. We can also identify the set point was adjusted down on the Saturday which made the control a bit more stable but applied additional load to the system. Our comparison data was taken from the data from 23/3/14 which was the same set point as the rest of the trial.

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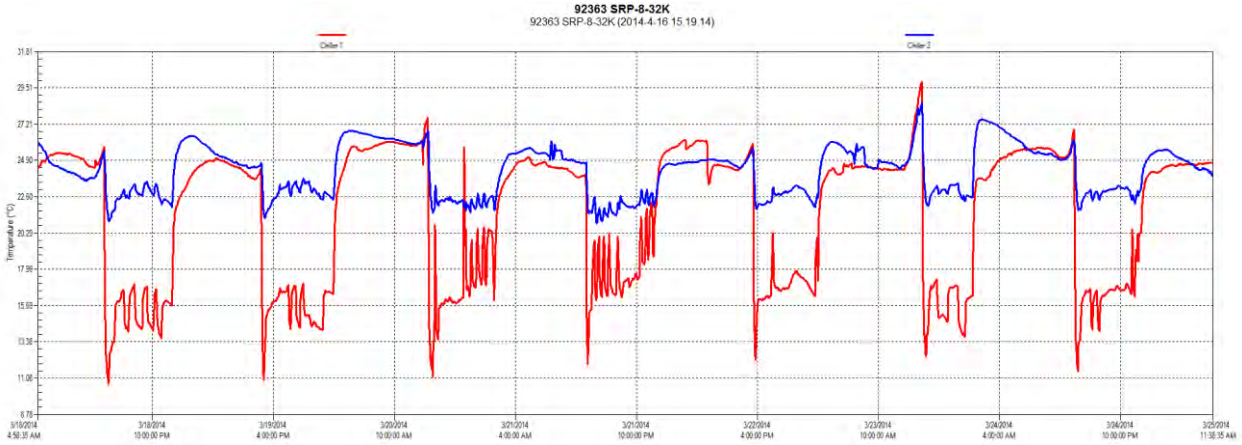
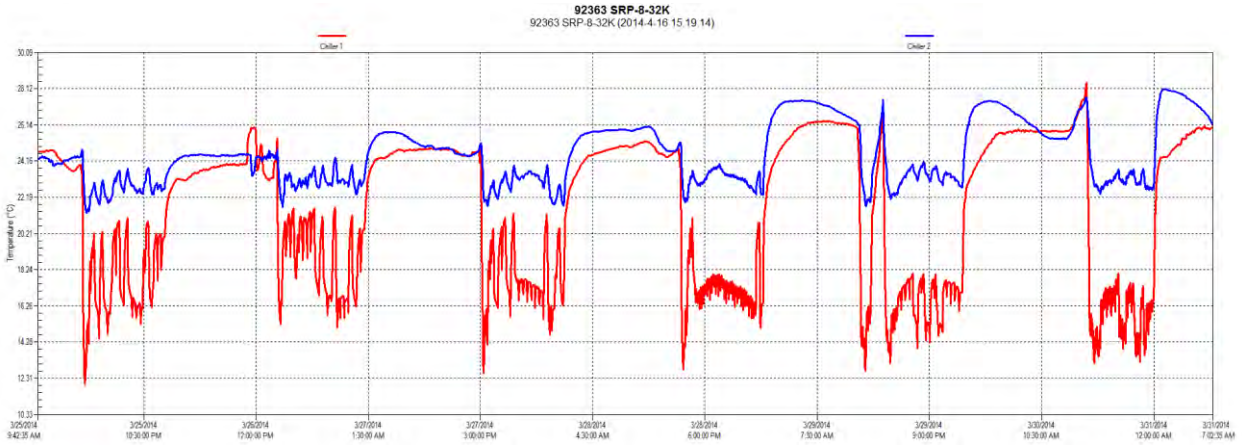
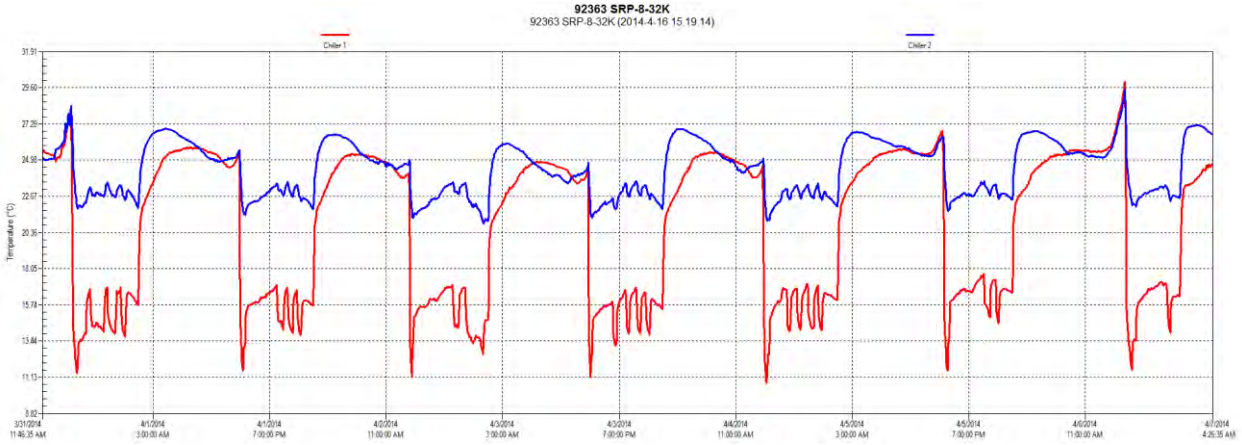


<u>Week 2 Air On/Air Off temperatures</u>
Smartcool Only



<u>Week 3 Air On/Air Off temperatures</u>
With Aeris Treatment



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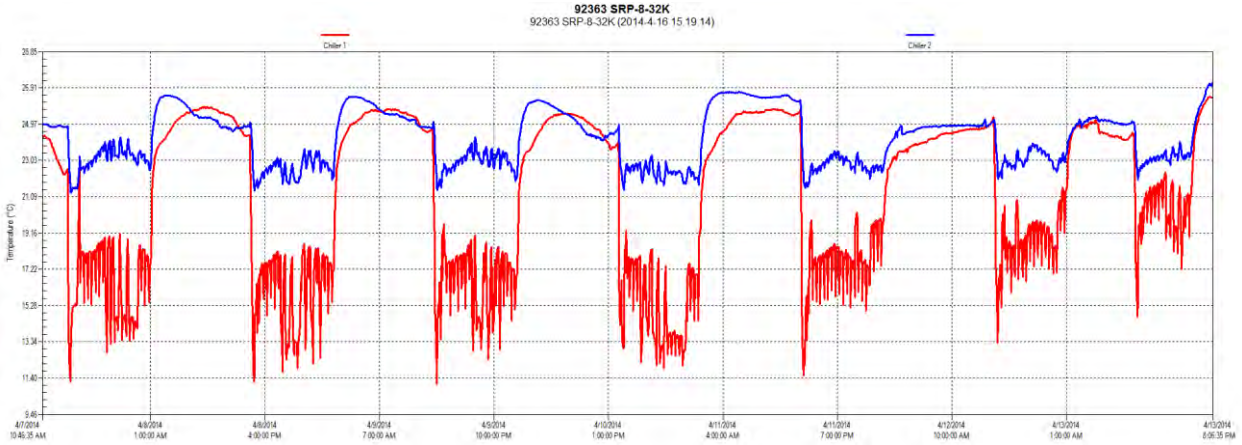
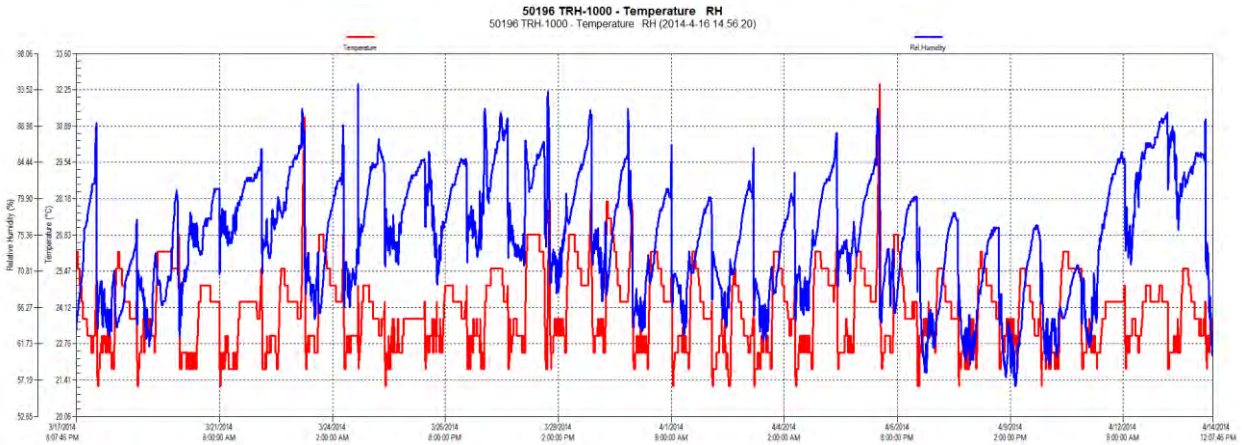
Week 4 Air On/Air Off temperatures

With Smartcool and Aeris



/------Cyclone-----/

Return Air Temperature and Relative Humidity



/----Control Only------/-Smartcool Only--/------Aeris Only--------/---Smartcool Aeris----/

/--------Week 1--------/-------Week 2-------/--------Week 3----------/---------Week 4--------/

The above Graph shows the ability of the Smartcool system to reduce the effect of high humidity. The combined effect of Smartcool and Aeris on the relative humidity is obvious until the last 2 days when the region was directly affected by a cyclone where humidity was 100%. Regardless of this we were able to maintain internal humidity conditions close to the days when the relative humidity was much lower.

Average Ambient Relative Humidity			
Existing Control	Smartcool Only	Aeris Only	Smartcool Aeris
71.70%	89.00%	71.40%	76%

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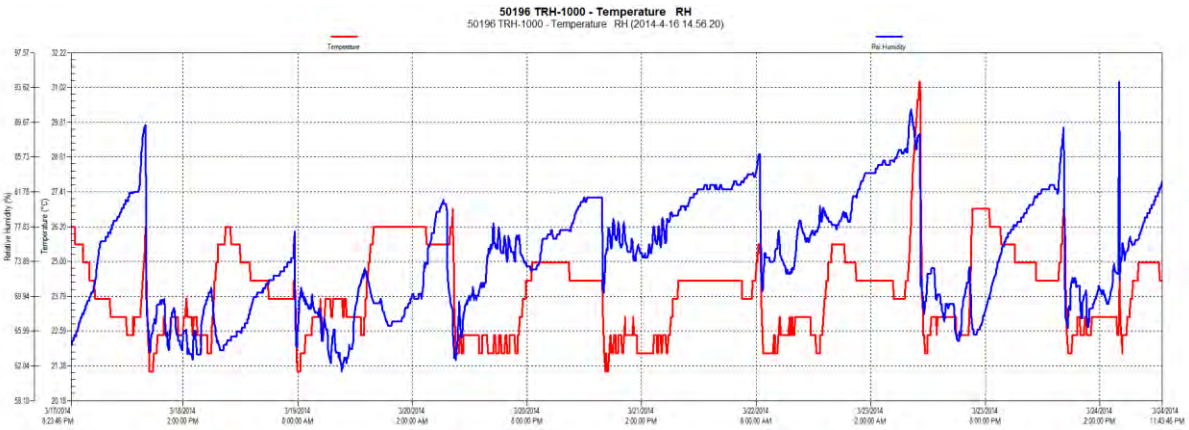
Daily Relative Humidity values

Month	Day	Date	RH %		Av RH
March	Tuesday	18	64	Week1	71.7
March	Wednesday	19	56		
March	Thursday	20	63		
March	Friday	21	93		
March	Saturday	22	76		
March	Sunday	23	76		
March	Monday	24	74		
March	Tuesday	25	96	Week 2	89.0
March	Wednesday	26	95		
March	Thursday	27	93		
March	Friday	28	94		
March	Saturday	29	75		
March	Sunday	30	81		
March	Monday	31	73	Week3	71.4
April	Tuesday	1	70		
April	Wednesday	2	70		
April	Thursday	3	63		
April	Friday	4	68		
April	Saturday	5	88		
April	Sunday	6	68		
April	Monday	7	68	Week 4	76.0
April	Tuesday	8	66		
April	Wednesday	9	61		
April	Thursday	10	68		
April	Friday	11	75		
April	Saturday	12	94		
April	Sunday	13	100		

<u>Week 1 Return Air Temperature and Relative Humidity</u>



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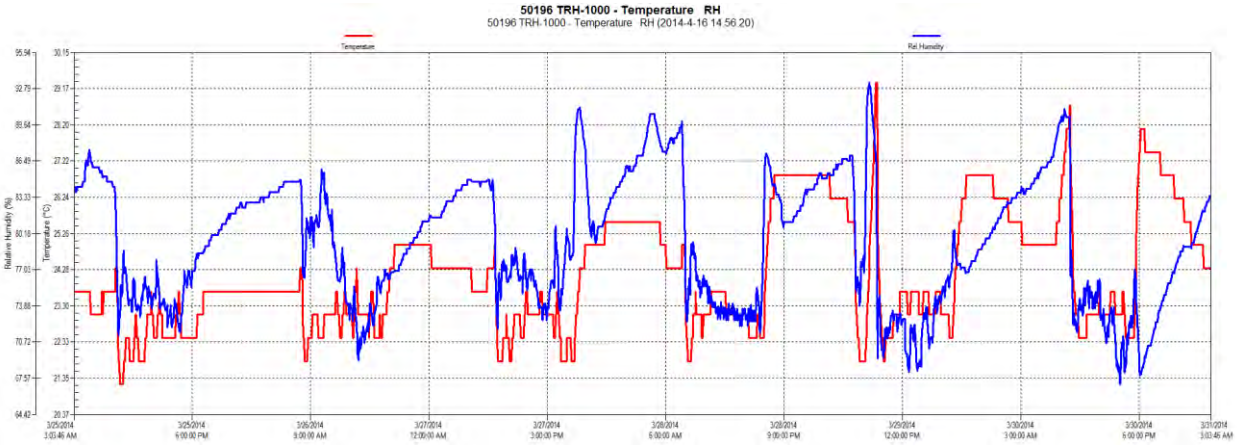
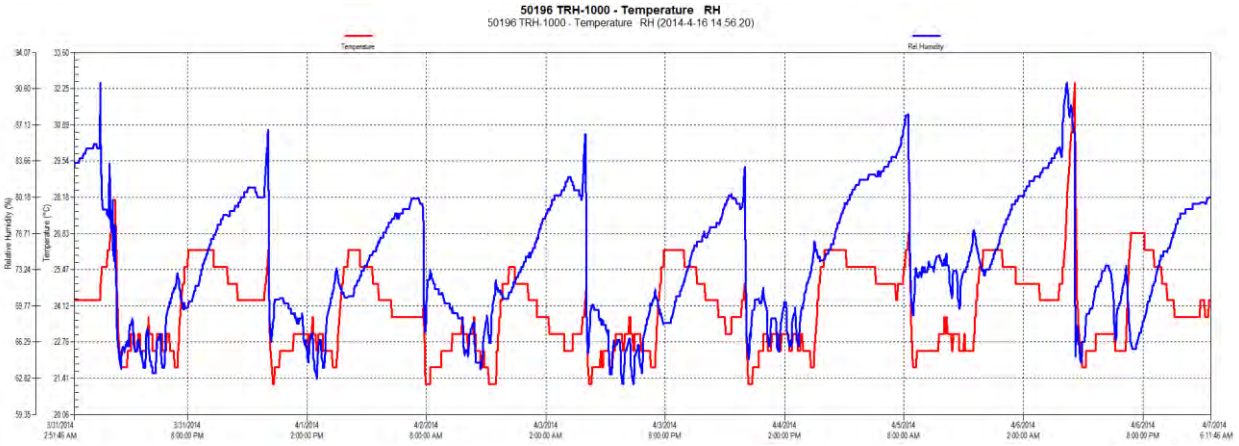
Week 2 Return Air Temperature and Relative Humidity



Week 3 Return Air Temperature and Relative Humidity



Week 4 Return Air Temperature and Relative Humidity